

Sept. 27, 1960

C. F. CARTER
FILLING MACHINE

2,954,203

Filed June 20, 1957

2 Sheets-Sheet 1

Fig. 1.

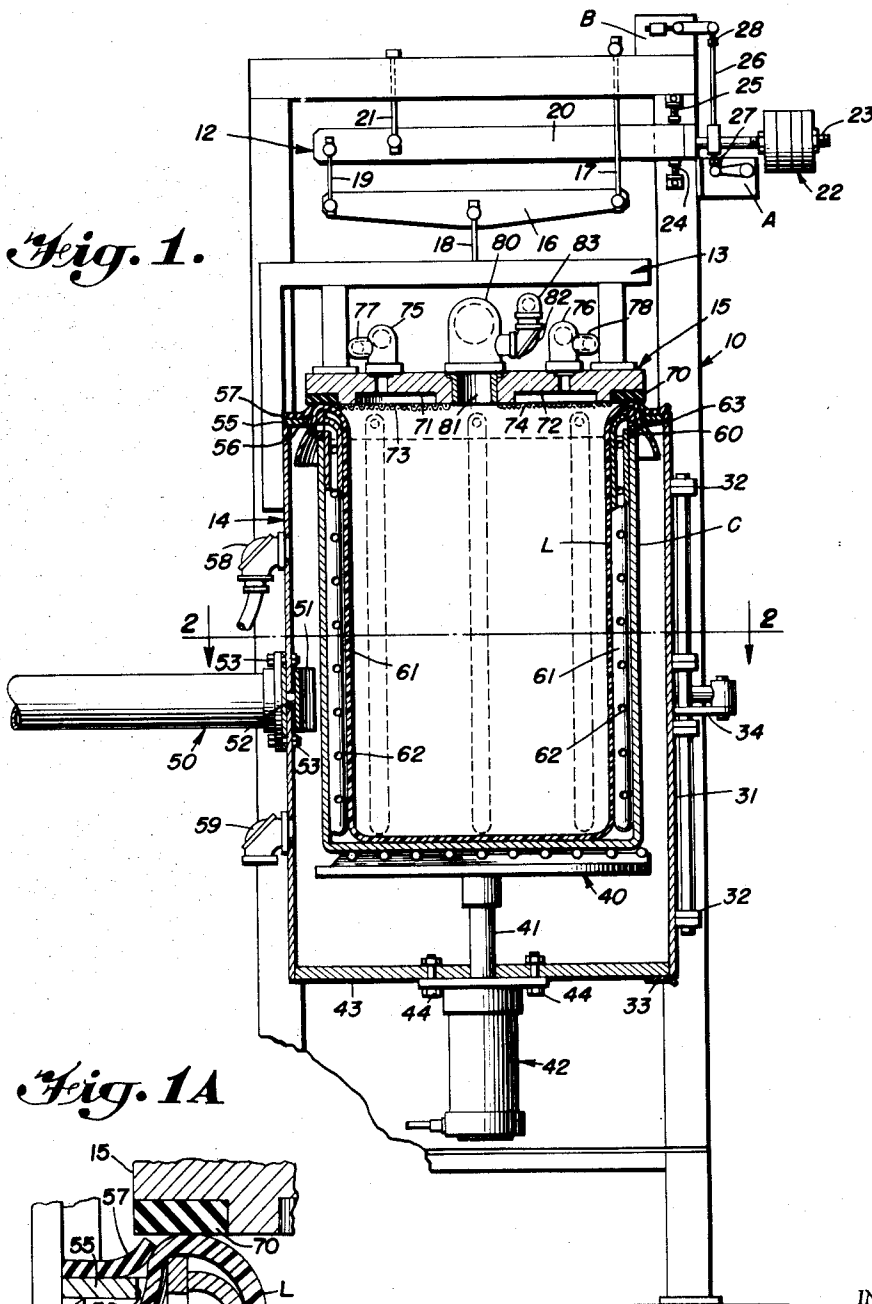
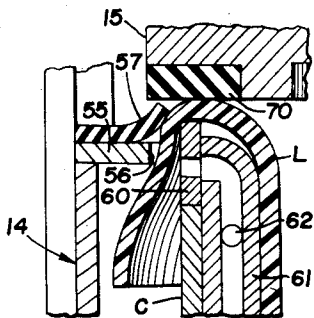


Fig. 1A



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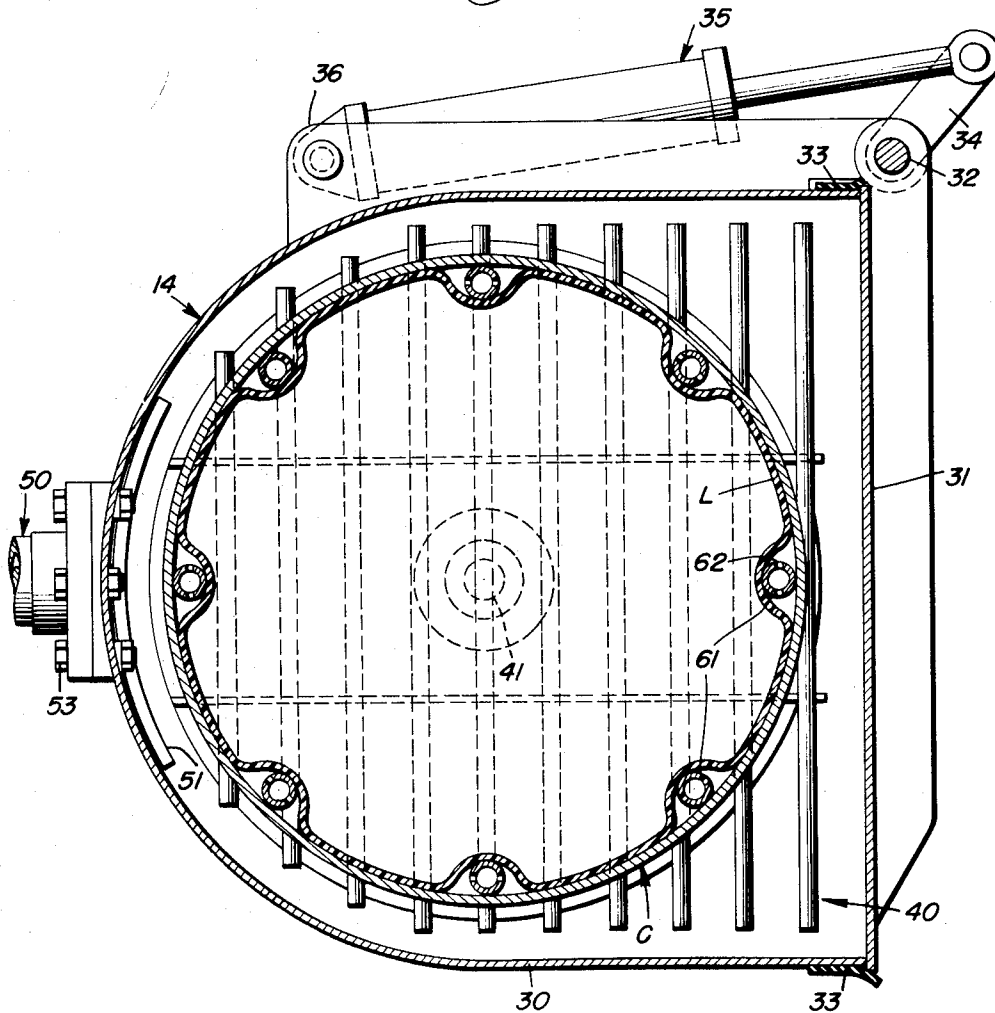
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Fig. 2.



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FILLING MACHINE

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6 Claims. (Cl. 249—64)

Generally, this invention relates to apparatus for filling receptacles with finely divided particulate material. In its more particular aspects, the invention is directed to apparatus for rapid, accurate weight-controlled filling of receptacles and, more specifically, for filling open mouth containers with particulate material.

In receptacle filling operations it is desired to achieve rapid filling of successive receptacles while maintaining uniformity in the weight of material discharged into each of the successive receptacles. It has been known to terminate the filling operation in response to the total weight of material dispensed into the receptacle being filled. Such prior art proposals are not always effective in achieving uniformity in the weights of material discharged into successive receptacles filled with the equipment, especially where rapid succession filling is attempted.

It has also been known in the prior art to effect filling of receptacles with particulate material employing a sub-atmospheric pressure or vacuum within the receptacle, to effect the filling operation. Such vacuum filling operations find particular utility in conjunction with finely divided particulate materials or powders which have a tendency to become fluffy and have a low density by reason of air entrained between the material particles. Where receptacles are being filled with powdered materials, seepage of such materials from the filling apparatus tends to create hazardous and unpleasant working conditions for the machine operators, and also promote accumulations of the powdered material in and around the various machinery parts, to obstruct their efficient operation.

In the prior art relating to vacuum filling, it has been proposed to position the container being filled in a chamber, which chamber is evacuated to preclude collapse of the container walls when the vacuum used in the filling operation is applied to the container interior. Where such a container enclosing chamber is subjected to a vacuum approximately equal to the vacuum used interiorly of the container for filling purposes, even a slight pressure differential between the interior and exterior may be such that upon separation of the filling head from the container, pressure within the container will blow some powdered material outwardly into the enclosing chamber, resulting in undesired accumulations of powder in such chamber and in and around the working parts of the filling machine.

The instant invention provides an apparatus which effectively overcomes the above referred to problems existent in prior art filling machine structures. Thus, it is a primary object of such invention to provide filling apparatus for rapid, accurate weight-controlled filling of receptacles effected by discharging material into the receptacle at the maximum flow rate until the scale mechanism responds to the weight of a nearly filled receptacle and thereafter continue to fill the receptacle at a substan-

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tially restricted flow rate until the desired fully filled state for the receptacle is reached.

It is a further object of this invention to provide filling apparatus for rapid, accurate weight-controlled filling, which apparatus includes a material supply conduit, the flow through which is controlled by a main and a secondary valve, and a scale mechanism having a beam member movable in response to the weight of the material in the receptacle being filled, with switch means actuated by said beam member and connected to close said main valve when the receptacle nears its fully filled state and simultaneously opens the secondary valve to permit substantially restricted material flow into the receptacle, until the beam member moves in response to the weight of a fully filled receptacle.

It is another principal object of this invention to provide apparatus particularly adapted for vacuum filling open mouth containers with particulate material, including a shroud cooperating with the exterior of the container to enclose a substantial portion of the container and terminating at a point spaced below the filling head so that the junction between the head and container is exposed to atmospheric pressure when the shroud and container interior are evacuated during filling to minimize the possibility of material passing from the container.

It is also an object of this invention to provide a filling apparatus as described in the preceding object, wherein the shroud is provided with a lateral access door and support means for the container within the shroud are operable to raise the container through an opening in the upper wall of the shroud to engage with the filling head for the filling operation.

Other and more specific objects, features and advantages of the instant invention will be apparent from the detailed description set forth hereinbelow. Such description, given in connection with the accompanying drawings which form a part of this application, is illustrative, merely by way of example, of a preferred form of the invention. Referring to the drawings:

Figure 1 is a side elevational view of the filling machine with parts thereof shown in section;

Figure 1A is a detailed sectional view of a portion of the filling machine of Figure 1; and

Figure 2 is a sectional view taken on line 2—2 of Figure 1, omitting details of the supporting framework of the filling machine.

As shown in Figure 1, the filling machine includes a supporting framework 10 which has mounted thereon a scale mechanism 12. The scale mechanism, by means of a suitable support structure 13, has suspended therefrom a shroud 14 which encloses a substantial portion of the receptacle being filled. Such receptacle is shown as a container C of the drum type. Also suspended from the scale mechanism by support structure 13 is a filling head 15.

The scale mechanism 12 includes a primary beam 16 connected at one end thereof to the overlying transverse element of framework 10, by a link 17. A link 18 connects beam 16 to the support structure 13. The opposite end of beam 16 is connected by link 19 to one end of a secondary scale beam 20. Beam 20 is connected intermediate its ends to the transverse overlying element of framework 10, by link 21.

The end of beam 20, opposite its point of connection with link 19, carries scale weights 22 which are suitably adjustable longitudinally thereof as by threads 23. It will be readily appreciated that the scale mechanism 12 is responsive to weight applied through link 18 so that the right end of beam 20, as shown in Figure 1, will tend to move up in accordance with the weight applied through link 18. The position of scale weights 22 rela-

tive to the longitudinal axis of beam 20 will determine the point at which beam 20 will move upwardly in response to weight applied to the scale mechanism. Suitable adjustable limit stops 24 and 25 may be provided to set, as desired, the upper and lower extent of movement of the right end of beam 20. A switch actuating member 26 is mounted on beam 20 adjacent weight 22 and is provided with adjusting devices 27 and 28, to adjust its length to determine the position at which it actuates lower and upper microswitches A and B. The purpose and functioning of these microswitches will be more apparent from the description given hereinafter.

Reference will now be had to the structure of the shroud 14 and the parts carried thereby. As shown more clearly in Figure 2, the shroud includes a generally U-shaped wall 30 having a lateral opening closed by an access door 31 hinged at 32 to one side of such opening. A suitable strip seal 33 is provided around the periphery of the door to seal the junction of the door with the shroud wall 30. A crank arm 34 is rigidly connected to extend outwardly from the door 31 and has connected thereto the piston rod of a pressure responsive actuator 35. The cylinder of such actuator is connected at 36 to the shroud wall 30. A support platform 40 for the container C is mounted interiorly of shroud 14 on the upper end of the piston rod 41 of a pressure responsive actuator 42. The cylinder of such actuator is secured to the bottom wall 43 of the shroud as by means of suitable threaded fasteners 44.

Also carried by the shroud is a container ejector 50 to assist in removing the filled container from the shroud. The ejector includes a plate 51 mounted on the inner end of a piston rod 52, which forms a part of a pressure responsive actuator. The cylinder of such actuator is connected to the wall 30 of the shroud by threaded fasteners 53.

The upper wall 55 of shroud 14 is provided with an opening 56 corresponding generally to the exterior cross section of the container C to be filled. A sealing strip 57 is provided around the periphery of opening 56 to cooperate with the container exterior or, when a container liner is employed as illustrated, with the exterior of the venting device to close the opening so that a subatmospheric pressure or vacuum may be applied within shroud 14 exteriorly of a substantial portion of container C.

Subatmospheric pressure or vacuum is applied to the interior of shroud 14 by connection therewith of a suitable vacuum line. The application of such vacuum to the shroud interior is controlled by a valve 58. To vent the shroud interior to atmospheric pressure at the completion of the filling operation, a vacuum relief control valve 59 is provided in the shroud wall 30.

In the embodiment illustrated on the drawings, the container C is shown provided with an impervious bag liner L. The use of such a liner is particularly advantageous where the material to be placed in the container must be protected from access to moisture. As shown more clearly in Figure 1 and Figure 1A, the upper open end of liner L turns down over the upper end of container C to lie beneath sealing strip 57 and the upper wall 55 of shroud 14.

A venting device, to insure effective removal of air which might be entrapped between liner L and the inner wall of container C, is associated with the container. This device includes a ring-like element 60 which is seated on the upper periphery of the container open end, with the liner L extending outwardly over the top of such ringlike element between such element and the filling head 15. A plurality of tubes 61 carried by element 60 and having perforations 62 extend downwardly along the inner wall of container C so that air between the liner L and container C may pass through the apertures, into such tubes and thence to the top of the con-

tainer and through cooperating apertures 63 in ringlike element 60.

It will be appreciated that with the sealing strip 57 cooperating with the upper end of liner L and the exterior of element 60 above apertures 63, the vacuum applied to the shroud interior will draw air through apertures 63 in element 60 from the tubes 61, so that the liner L will be drawn into close conforming engagement with the inner surface of container C.

Figure 1A shows in enlarged detail the relationship of the parts at the juncture of the container and liner carried thereby with the shroud and underside of the filling head as incorporated into the overall filling machine shown in Figure 1.

Although in the embodiment illustrated a container using an impervious liner has been illustrated, it will be appreciated that where containers are to be filled without employing impervious liners therefor, the liner and venting device shown in Figure 1 would not be used, and the upper end of container C would cooperate directly and engage with the underside of filling head 15. In such a filling operation, sealing strip 57 will seal against the exterior wall surface of container C adjacent its upper open end.

The filling head 15 embodies features of a split head type filler as shown and described, for example, in my prior copending application Serial No. 504,488, filed April 28, 1955, now Patent No. 2,815,621. The head carries a sealing gasket 70 mounted in the head to cooperate with the upper end of the container in sealing the junction between the head and container during the filling operation. As shown in Figure 1, the gasket physically contacts the upwardly facing surface of the out-turned end of liner L. Of course, where the liner is not used, gasket 70 will physically contact the upper end of container C, since the venting device will not be present.

In the split filling head, two compartments 71 and 72, covered by screens 73 and 74, respectively, are provided. The application of vacuum to chamber 71 and thence through screen 73 to the interior of the container is controlled by a valve 75 in a vacuum line leading to chamber 71. Similarly, control of the application of vacuum to chamber 72 and thence through screen 74 to the container interior, is controlled by a valve 76. A relief valve 77 is provided to admit air to chamber 71 to blow screen 73 clean, and a relief valve 78 provided to admit air to chamber 72 to effect cleaning of screen 74.

Preferably, the timing and operation of the various valves, including the shroud vacuum control valve 58, shroud relief valve 59, head vacuum valve 75, head vacuum valve 76, head relief valve 77 and head relief valve 78, together with the main material supply valve to be described, will be effected in accordance with the description of operation as set forth in the hereinabove referred to copending application. In essence, such operation will apply vacuum to the shroud interior enclosing the container during the filling operation, and with the main material supply valve open, vacuum will alternatively be drawn through screens 73 and 74 by alternative opening and closing of valves 75 and 76. During each container filling operation, the procedure is carried out to provide incremental filling with the vent valves 77 and 78 being only momentarily opened between introduction of increments of material into the container to admit limited reverse flow of air to clean the screens 73 and 74 without returning the pressure interiorly of the container to atmospheric pressure.

The head, in addition to the hereinabove described valves, includes a main material supply valve 80, which constitutes the primary control for the flow of particulate material through conduit 81 and thence into the container C. A secondary valve 82 is provided in a line communicating with the material supply, so that with the main valve 80 closed and secondary valve 82 open, a substantially restricted rate of flow of material

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through conduit 81 and into container C will take place. The amount of restricted flow through secondary valve 82 may be varied within the flow capacity of valve 82 by provision of a suitable adjustable gate restrictor 83 positioned in the line leading to valve 82.

It will be readily recognized that all of the fluid pressure lines, material supply lines and any other connections extending to and from the shroud and filling head will be suitably flexible to permit appropriate movements of the shroud and head as the scale mechanism 12 responds to the weight of material discharged into a container being filled.

As referred to hereinabove, preferably an incremental filling method as disclosed in my copending application, Serial No. 504,488, filed April 28, 1955, now Patent No. 2,815,621, is employed in filling container C, since such a method produces improved results with finely divided particulate material by achieving improved compacting of such material. Applying such a method to the apparatus of the instant invention, it will be apparent that the vacuum existent within container C during the filling operation will tend to create an inflow of air from the surrounding atmosphere through the junction of gasket 70 with the upper end of container C. Thus, if air should leak past such junction, the flow would be inwardly, thereby minimizing the possibility of loss of powdered material through such junction. Likewise, when the cooperation between head 15 and the upper end of the container is interrupted, any pressure differential will be toward the container interior, such that powdered material will not be blown outwardly to contaminate the surrounding mechanism.

Reference will now be had to the operation of microswitches A and B, which are actuated by movements of scale beam 20 in controlling accurate weight filling of container C. As material is discharged into the container as, for example, during the incremental filling operation, and the weight of such material in a nearly filled container approaches the point at which scale beam 20 starts to move upwardly, microswitch A is operated. This switch is connected to effect closing of the main material supply valve 80 and simultaneously open the secondary valve 82. Thereupon, the rate of flow of material into the container will be substantially curtailed due to the restricted amount flowing through valve 82 and the gate restrictor 83. The restricted rate of flow of material will tend to retard upward movements of scale beam 20.

When the container is fully filled to the desired degree, the microswitch B will be operated by beam 20 moving to its upper position. Switch B is connected to effect closing of secondary valve 82 and thereby terminate admission of material into the container. It will, of course, be appreciated that with closing of valve 82, the filling operation is terminated and that the shroud relief valve 59 will be opened, along with one or the other of vent valves 77 and 78, so that the container C may be lowered and removed from the shroud to be replaced with an empty container to be filled.

By adjusting the longitudinal position of weights 22 on beam 20 and/or adjusting the devices 27 and 28, the scale mechanism can be set to balance out the empty weight of the container and the machine set to terminate full flow filling and the total fill weight at the desired points.

Having described the specific structure and specific operational details of various features of the invention, a complete description of a filling operation performed with the apparatus will now be given. With the shroud door 31 open and container support platform 40 in a lowered position, an empty container C is positioned within shroud 14 on platform 40. The shroud door is closed by appropriate application of fluid pressure to actuator 35 and the platform raised by appropriate application of fluid pressure to the interior of actuator 42.

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This latter step will result in container C being raised to project the upper end thereof through opening 56 into engagement with gasket 70 on head 15. If a liner L is used, the venting device will be in position on the container rim and the liner and venting device will assume the relationship as shown in Figure 1.

At this point, with no material in the container, the right end of scale beam 20 rests against the lower stop 24. Valve 58 is opened, along with one or the other of valves 75 and 76, to apply vacuum to the shroud interior and to the interior of the container. The main supply valve 80 opens to admit material into the container. The incremental filling procedure is then carried out to discharge increments of material through main valve 80 and conduit 81, and into container C.

When the container approaches a nearly filled condition, the right end of scale beam 20 moves, operating microswitch A, which effects closure of main valve 80 and opening of secondary valve 82. With the actuation of microswitch A, the incremental filling procedure is terminated. For the remainder of the filling, by the addition of limited quantities of material through secondary valve 82, the vacuum within the container may be drawn through one or another of valves 75 and 76. When the container reaches the fully filled state, microswitch B is actuated, closing secondary valve 82 and venting the container and shroud interiors. Thereupon pressure is released from actuator cylinder 41 to lower the container downwardly into the shroud, the shroud door is opened by appropriate application of pressure to actuator 35 and pressure is applied to ejector 50 to move plate 51 outwardly and push the filled container out of the shroud.

A particular preferred embodiment of the invention has been illustrated and described herein. It is to be understood, however, that the broader scope of the invention is defined by the following claims.

Having thus described my invention, I claim:

1. Apparatus for filling open mouth containers with particulate material comprising a shroud to enclose a substantial portion of the container during filling and having a laterally opening access door for introduction into the shroud of the container to be filled, said shroud having in the upper wall thereof an opening corresponding generally to the exterior cross section of the container, support means for positioning the container within the shroud with the upper open end thereof extending through and sealingly cooperating with said opening, a filling head spaced above said opening and sealingly operable with the upper open end of the container, means for applying a vacuum to the interior of the container through said head and to the interior of said shroud, and material supply means opening through said head to discharge material into the container to be filled.

2. Apparatus for filling open mouth containers with particulate material as recited in claim 1 wherein said access door is provided with pressure-operated means to effect opening and closing thereof, and a seal means extends around the junction of said door with the shroud.

3. Apparatus for filling open mouth containers with particulate material comprising a shroud to enclose a substantial portion of the container during filling and having a laterally opening access door for introduction into the shroud of the container to be filled, said shroud having in the upper wall thereof an opening corresponding generally to the exterior cross section of the container, support means for the container within said shroud operable to raise the container and project the upper open end thereof through said opening with the exterior wall of such container below the upper open end sealingly cooperating with said opening, a filling head spaced above said opening and sealingly cooperable with the upper open end of the container, means for applying a vacuum to the interior of the container through said head and to the interior of said shroud, and material supply means

opening through said head to discharge material into the container to be filled.

4. Apparatus for filling open mouth containers with particulate material as recited in claim 3 wherein said support means includes a horizontal platform on which the container to be filled is placed, and a pressure responsive actuator connected to said platform and mounted in the bottom of said shroud to raise and lower said platform.

5. Apparatus for filling open mouth containers with particulate material as recited in claim 3 wherein said opening in the upper wall of said shroud is provided with seal means cooperable with the container to provide a chamber for the application of vacuum to a substantial portion of the container exterior during filling.

6. Apparatus for filling open mouth containers with particulate material comprising a supporting framework, a scale mechanism carried by said framework, a shroud having in the upper wall thereof an opening corresponding generally to the exterior cross section of the container to be filled, a filling head spaced above said opening and sealingly cooperable with the upper end of the container during filling, support means for positioning the container with the upper open end thereof extending through and sealingly cooperating with said opening, said shroud and filling head being supported by said framework through said scale mechanism; means for applying a vacuum to the interior of the container through said head and to the interior of said shroud, material supply

means opening through said head to discharge material into the container to be filled, and means positioned to be operated by said scale mechanism to restrict flow of material into the container when the container approaches a fully filled condition and to terminate flow of material into the container when the container is fully filled.

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